Supporting information:

Polymerization-tailored polyimides as cathodes for lithium-ion batteries

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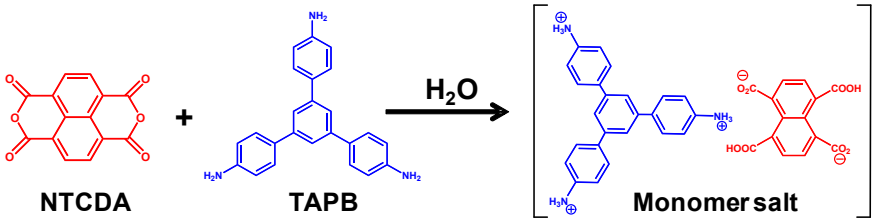


Fig. S1 Synthetic routes of monomer salt.

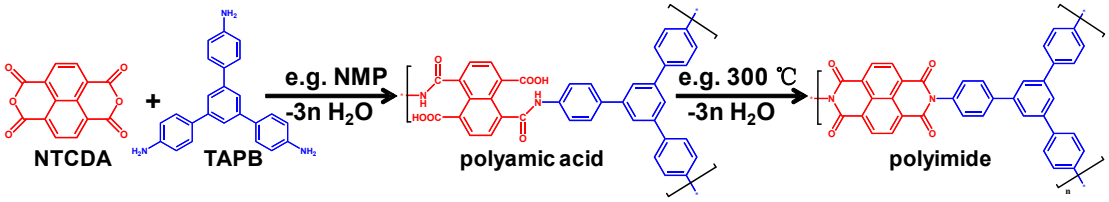


Fig. S2 Synthetic route of polyimide by one-step polycondensation.

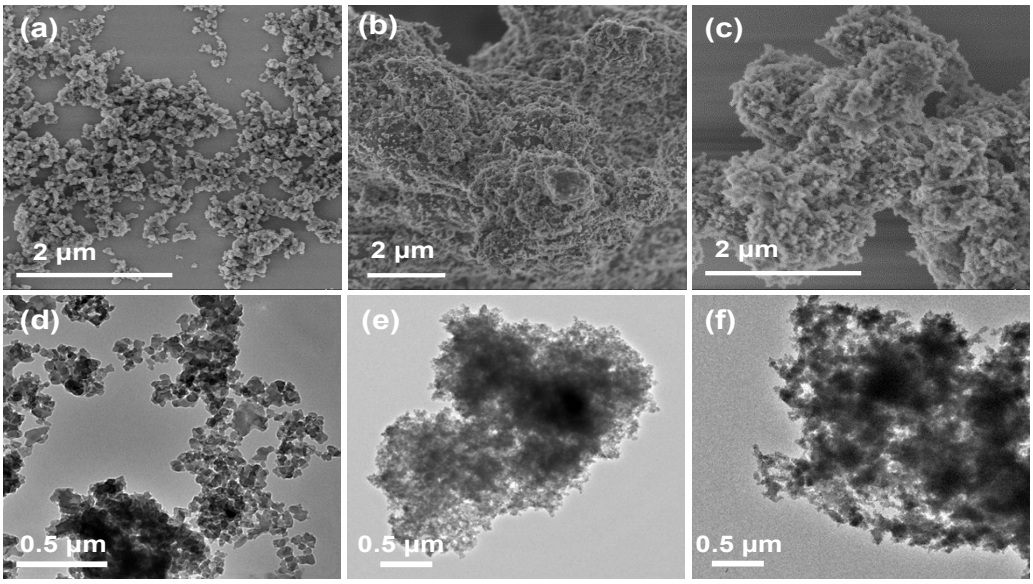


Fig. S3 SEM images of (a) sPI, (b) cPI and (c) PI-COF. TEM images of (d) sPI, (e) cPI and (f) PI-COF.

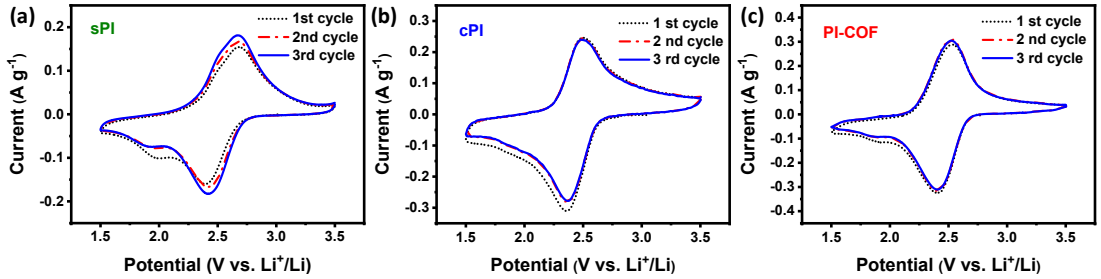


Fig. S4 CV curves of the (a) sPI, (b) cPI and (c) PI-COF from 1st to 3rd cycles at a scan rate of 1 mV s^{-1}.

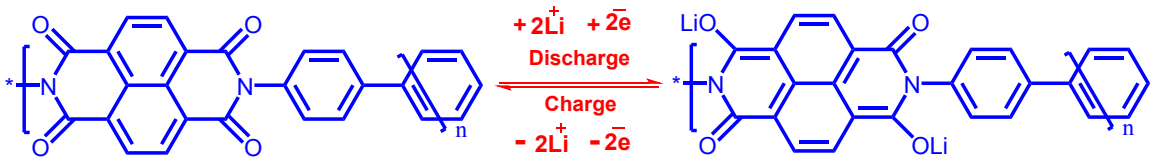


Fig. S5 Electrochemical redox mechanism of PIs.

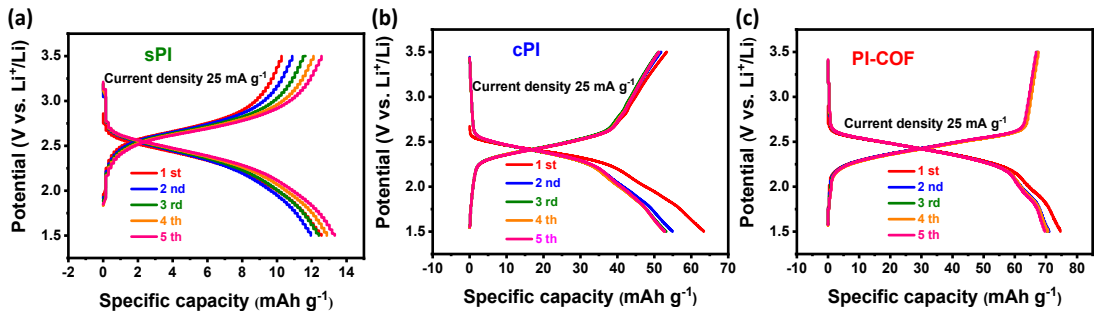


Fig. S6 Discharge-charge curves of (a) sPI, (b) cPI and (c) PI-COF at current density of 25 mA g^{-1}.

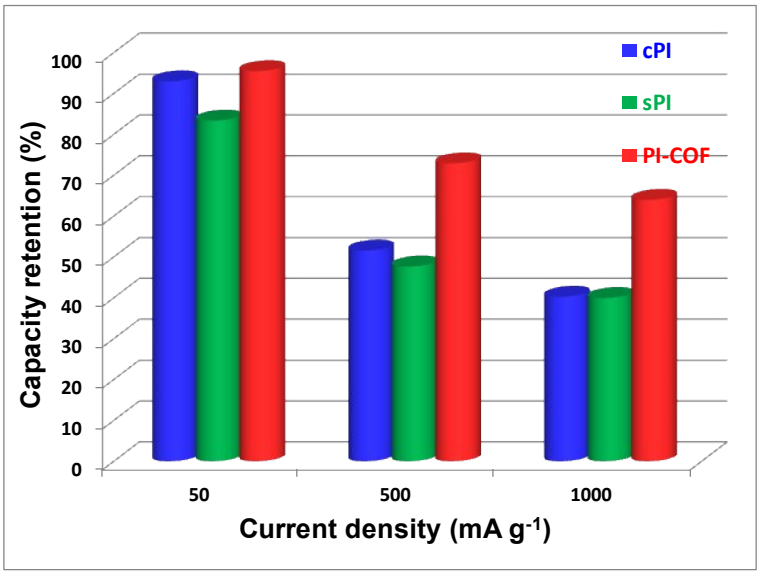


Fig. S7 Retention of initial capacity at different current densities for sPI, cPI and PI-COF.

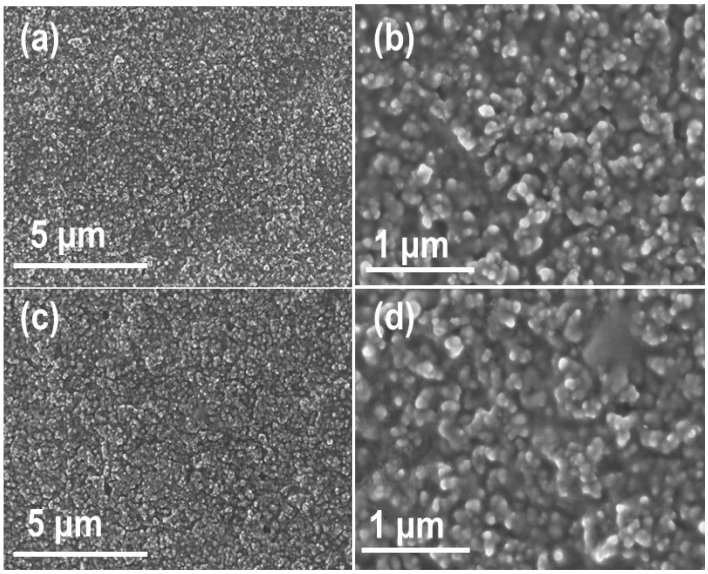


Fig. S8 The SEM images of sPI cathodes (a, b) before and (c, d) after cycling.

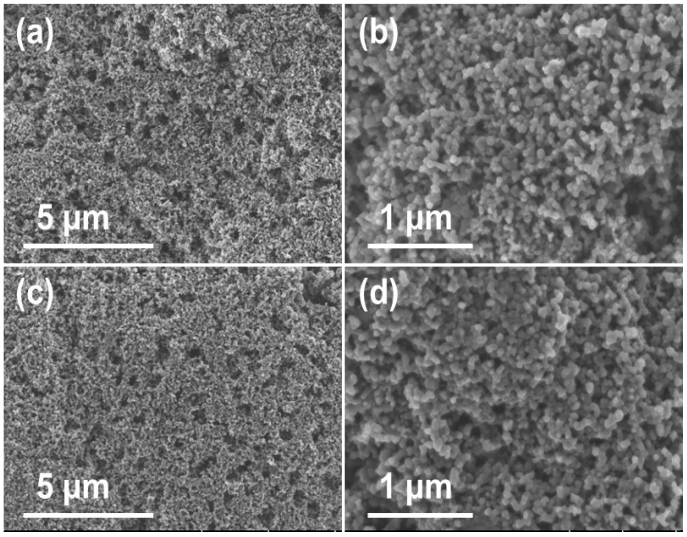


Fig. S9 The SEM images of cPI cathodes (a, b) before and (c, d) after cycling.

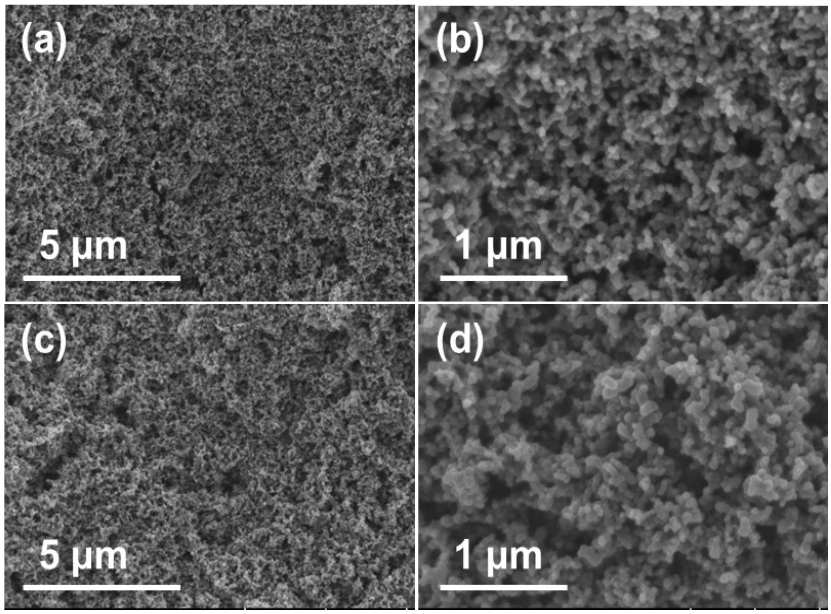


Fig. S10 The SEM images of PI-COF cathodes (a, b) before and (c, d) after cycling.

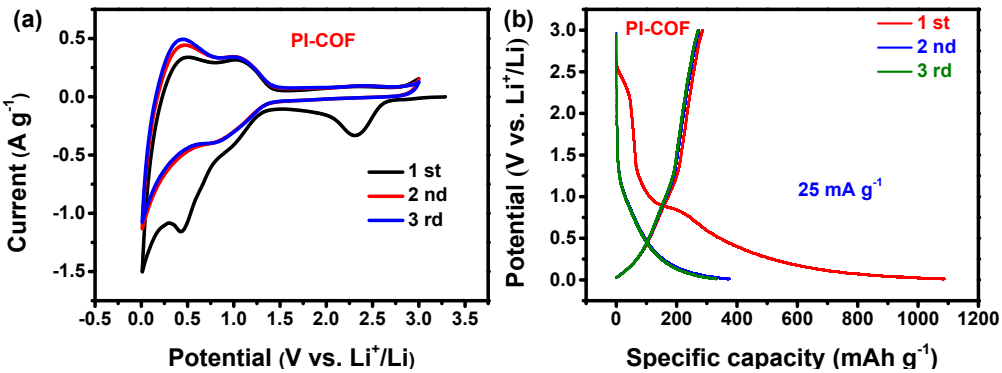


Fig. S11 (a) CV curves of PI-COF anodes between 0.01 and 3.0 V at a scan rate of 1 mV s^{-1}. (b) Charge-discharge curves of PI-COF anodes at current density of 25 mA g^{-1} in a potential window of 0.01-3 V.

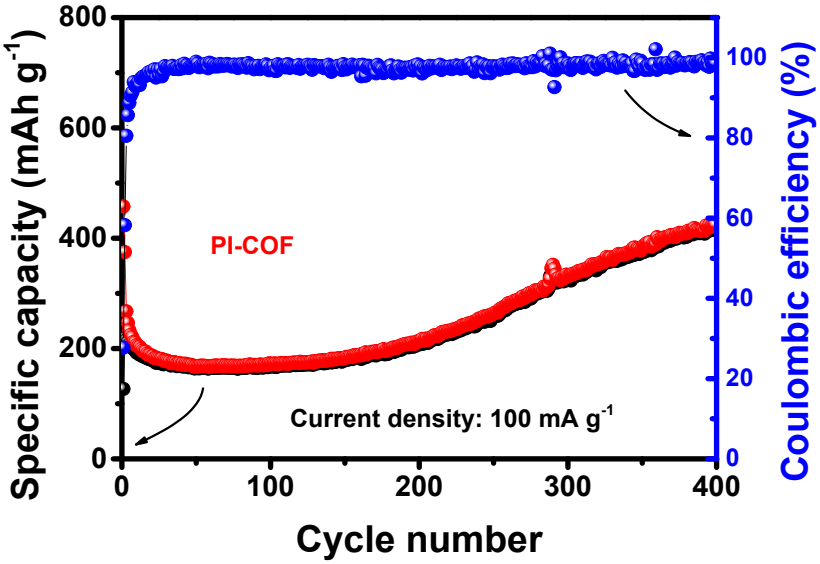


Fig. S12 Cycling performance of PI-COF anodes at 25 mA g^{-1} between 0.01 and 3.0 V.

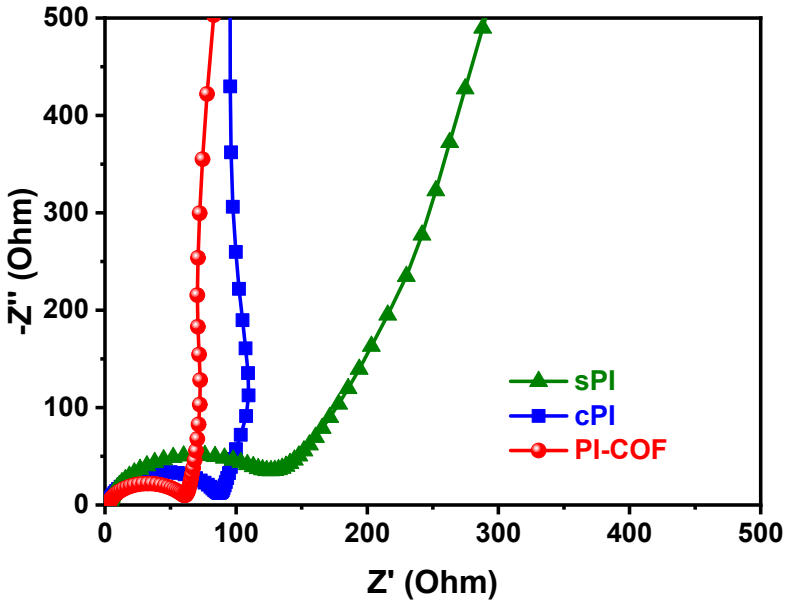


Fig. S13 (a) EIS profiles of sPI, cPI and PI-COF.

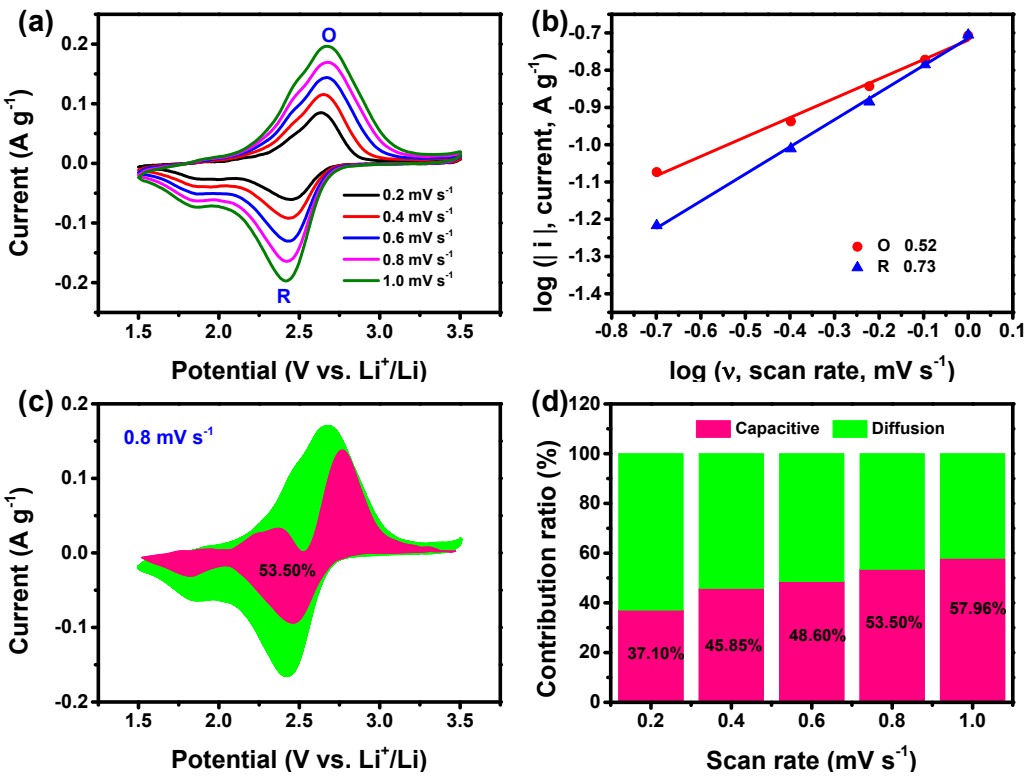


Fig. S14 (a) CVs curves at different scan rates, (b) log i *vs* log v plots, (c) contribution ratios of capacitive- and diffusion-controlled behaviors and (d) capacitive and diffusion-controlled contribution to charge storage (0.8 mV s^{-1}) at different scan rate for sPI.

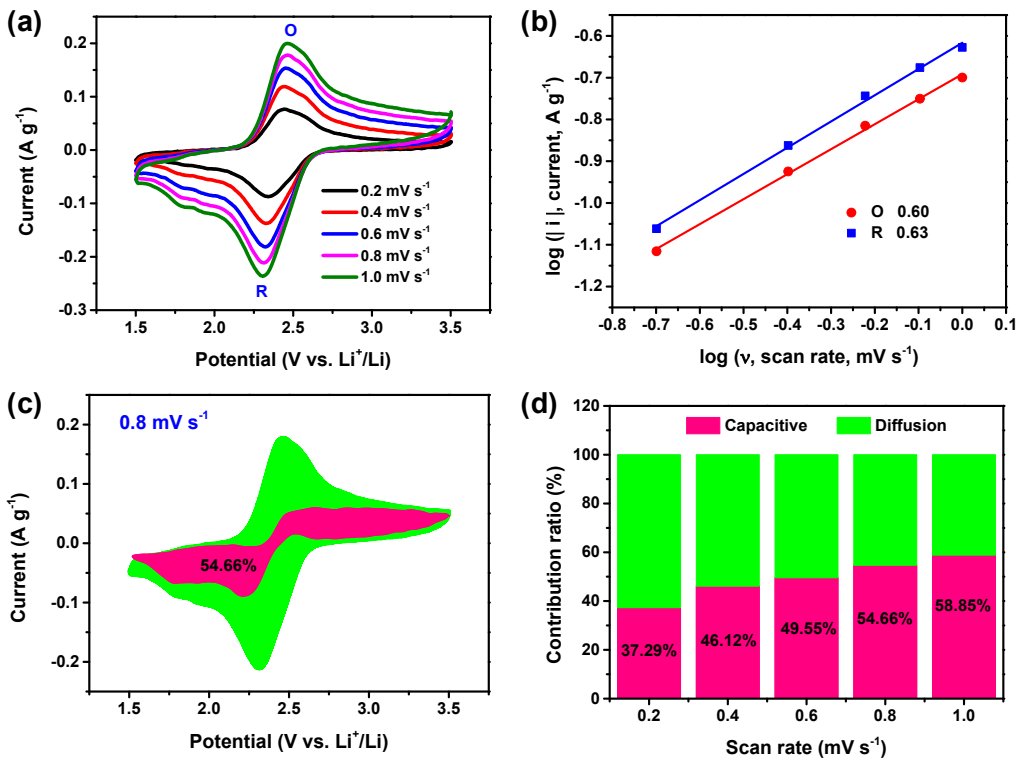
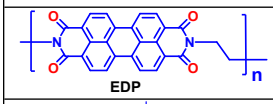
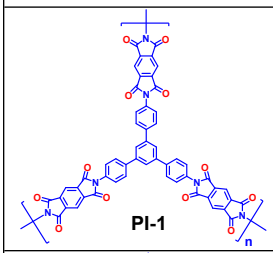
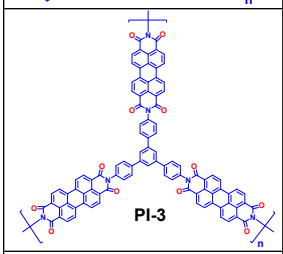
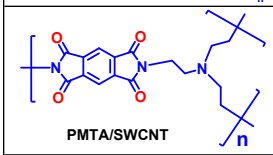
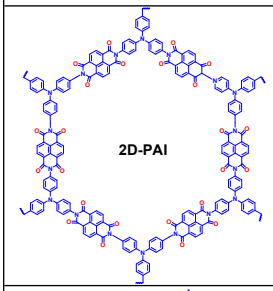
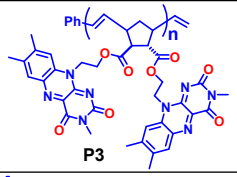
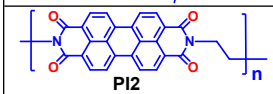
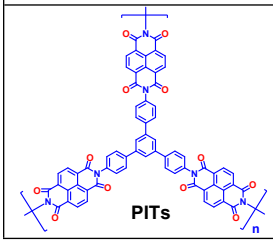


Fig. S15 (a) CVs curves at different scan rates, (b) log i *vs* log v plots, (c) contribution ratios of capacitive- and diffusion-controlled behaviors and (d) capacitive and diffusion-controlled contribution to charge storage (0.8 mV s^{-1}) at different scan rate for cPI.

Table S1. A comparison in the electrochemical performance between as-prepared PIs and previous-reported polymer cathodes.

Materials	Capacity	Rate Capability	Capacity Retention	Capacity utilization	Ref.
 EDP	85 mAh g^{-1} at 50 mA g^{-1}	0 mAh g^{-1} at 200 mA g^{-1}	88.2% after 50 cycles at 50 mA g^{-1}	65.8%	[1]
 PI-1	36 mAh g^{-1} at 25 mA g^{-1}	-	-	21.3%	[2]
 PI-3	78 mAh g^{-1} at 25 mA g^{-1}	-	74.1% after 65 cycles at 25 mA g^{-1}	71.4%	
 PMTA/SWCNT	160 mAh g^{-1} at 38.3 mA g^{-1}	74 mAh g^{-1} at 3.83 A g^{-1}	86.6% after 200 cycles at 191.5 mA g^{-1}	-	[3]
 2D-PAI	28.5 mAh g^{-1} at 100 mA g^{-1}	-	100% after 50 cycles at 100 mA g^{-1}	22.6%	[4]
 P3	53 mAh g^{-1} at 150 mA g^{-1}	25 mAh g^{-1} at 3.0 A g^{-1}	28.0% after 200 cycles at 144 mA g^{-1}	-	[5]
 PI2	134.9 mAh g-1 at 25 mA g^{-1}	50 mAh g^{-1} at 9.9 A g^{-1}	87.5% after 5000 cycles at 198 mA g^{-1}	54.3%	[6]
 PITs	80.5 mAh g^{-1} at 25 mA g^{-1}	56.5 mAh g^{-1} at 1.0 A g^{-1}	70.3% after 15000 cycles at 1.5 A g^{-1}	70%	[7]*

 PI-COF	**70.6 mAh g^{-1} at 25 mA g^{-1}**	**47.0 mAh g^{-1} at 1.0 A g^{-1}**	**80% after 10000 cycles at 1.5 A g^{-1}**	**61.4%**	**This work**

* The PITs were synthesized by hydrothermal polycondensation method. Hydrothermally self-templated synthesis of rectangular polyimide submicrotubes proposed by our previous work.

Reference

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[2] D. Tian, H. Z. Zhang, D. S. Zhang, Z. Chang, J. Han, X. P. Gao and X. H. Bu, RSC Adv., 2014, **4**, 7506.

[3] H. Wu, Q. Meng, Q. Yang, M. Zhang, K. Lu and Z. Wei, Adv. Mater., 2015, **27**, 6504.

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[5] T. B. Schon, A. J. Tilley, C. R. Bridges, M. B. Miltenburg and D. S. Seferos, Adv. Funct. Mater., 2016, **26**, 6896.

[6] H. G. Wang, S. Yuan, D. L. Ma, X. L. Huang, F. L. Meng and X. B. Zhang, Adv. Energy Mater., 2014, **4**, 1301651.

[7] Lei S, Cui X, Liu X, et al. Hydrothermally self-templated synthesis of rectangular polyimide submicrotubes and promising potentials in electrochemical energy storage. Chem. Commun., 2020, **56**, 1429.